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Journal of Magnetism and Magnetic Materials 304 (2006) e501–e503
Journal of magnetism and magnetic materials
www.elsevier.com/locate/jmmm

Magnetic structure and Mössbauer study of Fe–Cr-based selenide

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Available online 15 March 2006

Abstract

Sample of $FeCr_2Se_4$ has been studied with X-ray and neutron diffraction, vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. The crystal structure of $FeCr_2Se_4$ has a monoclinic (space group I2/m) phase, with the lattice constants $a = 6.26$ Å, $b = 3.61$ Å, $c = 11.82$ Å, and $\beta = 90.68^\circ$, respectively. The neutron diffraction patterns were observed from 4 K to room temperature. The magnetic super structure peak disappeared above the Néel temperature. This result is in agreement with the VSM measurements. Temperature dependence of magnetic susceptibility showed an anomalous antiferromagnetic system. The Mössbauer spectra were obtained at various temperatures from 4.2 K to room temperature. Mössbauer spectrum shows a severe line broadening at 4.2 K, and it gives a direct evidence of a large quadrupole interaction in this material, compared to magnetic dipole interaction. The Mössbauer spectrum consists of a doublet at room temperature, denoting a distorted monoclinic symmetry.

PACS: 61.66.DK; 75.47.GK; 76.80.+y

Keywords: Selenide; $FeCr_2Se_4$; Mössbauer spectroscopy; Neutron diffraction